SEPSTER and SEPSTER2D

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Description

SEPSTER and SEPSTER2D predict the peak SEP intensity and time of peak intensity by using analytic equations derived from historic events that relate CME speed, CME width, and connectivity angle to the peak SEP intensity.

Inputs

CME Speed and Width: From SOHO/LASCO once analyzed by M2M and entered into the DONKI database.

Connectivity Angle: From DSCOVR/Plasmag as a primary source and ACE/SWEPAM as a secondary source. If neither, uses 450 km/s and the Parker spiral equation.

Outputs

Peak Proton Intensity: For each model version and energy range listed below.

Time of Peak: For each model version and energy range listed below.

Model Version	Energy Range (MeV)
SEPSTER (Parker Spiral or WSA-ENLIL)	14-24
	>10
	>30
	>50
	>100
SEPSTER2D	>10
	>100

Forecast Lag Time

Inputs: About 45 minutes for CME parameters to be entered into DONKI (if M2M staffed, about 8-16 hours if not staffed)

Run Time: Less than 1 minute.

Interpretation and Caveats

Peak: SEPSTER predicts the onset peak since ESP phases were excluded in training. SEPSTER2D included ESP phases in training and therefore predicts the entire event peak.

Symbols: Predictions are displayed at the prediction window start time – not the peak time.

Versions: Parker Spiral: uses the analytic equation for a Parker spiral to calculate the connectivity angle. The inner boundary is the solar surface (about 21.5 R_S). This version was deemed a better physical interpretation because the peak of SEP acceleration occurs at the solar source surface. WSA-ENLIL: uses the WSA-ENLIL model with current heliospheric conditions to calculate the connectivity angle. The inner boundary is the surface of the Sun.

Triggers: SEPSTER triggers on CME speeds above 200 km/s and half-widths above 10 deg. SEPSTER2D triggers on CME speeds above 600 km/s and half-widths above 20 deg.

All-clear: SEPSTER predicts an All-clear for CMEs with speed×half-width<15000 to reduce false alarms. SEPSTER2D predicts an All-clear if the predicted intensity is below the operational threshold.

High Energy Predictions: SEPSTER approximations are based on correlations from the original 14-24 MeV predictions to GOES integral channels. SEPSTER2D predictions are directly derived from historic events.

Radio Filter: The SEP Scoreboard versions do not filter events based on radio.

Additional Links

iSWA Data Tree (SEPSTER)	CCMC SEPSTER Description
iSWA Data Tree (SEPSTER2D)	CCMC SEPSTER2D Description

Validation

	Categorical				Peak Intensity			Peak Timing			AWT (hrs)
Model Version	H	FAR	TSS	HSS	MLE	MALE	R	ME	MAE	R	ME
SEPSTER 14-24 MeV (Parker|WSA-ENLIL)	0.81 |	0.31 |		0.79 |							
SEPSTER >10 MeV (Parker|WSA-ENLIL)	0.77 | 0.82	0.23 | 0.18	0.65 | 0.74	0.35 | 0.38	-0.31 | -0.31	0.74 | 0.79	0.31 | 0.37				5.0 | 5.1
SEPSTER >30 MeV (Parker|WSA-ENLIL)	0.91 | 0.90	0.17 | 0.10	0.84 | 0.87	0.42 | 0.44	-0.53 | -0.42	0.89 | 0.83	0.32 | 0.33				3.77 | 3.93
SEPSTER >50 MeV (Parker|WSA-ENLIL)	0.56 | 0.86	0.00 | 0.14	0.56 | 0.83	0.33 | 0.42	-0.44 | -0.31	1.00 | 1.00	0.05 | -0.41				4.18 | 4.46
SEPSTER >100 MeV (Parker|WSA-ENLIL)	0.60 | 0.60	0.25 | 0.25	0.57 | 0.57	0.33 | 0.32	-0.66 | -0.55	1.15 | 1.06	-0.90 | -0.88				2.59 | 2.59
SEPSTER2D >10 MeV	0.86	0.29	-0.14	0.09	0.15	0.48	0.65				15.35
SEPSTER2D >100 MeV	0.60	0.25	0.53	0.31	-0.48	0.67	0.66				-14.42